comprising pentane and cyclopentane at a spinning temperature from about 205°C to 220°C to form substantially continuous polyethylene plexifilamentary fiber strands, collecting said plexifilamentary fiber strands to form a sheet and bonding said sheet to form said nonwoven unitary fibrous sheet comprised of substantially continuous polyethylene plexifilamentary fiber strands and having a Frazier Permeability, normalized to 1.0 oz/yd^2 basis weight, of at least 2 cfm/ft^2.

30. A nonwoven sheet produced by a process comprising flash spinning a solution of 12% to 24% by weight polyethylene in spin agent comprising pentane and cyclopentane at a spinning temperature from about 205°C to 220°C to form substantially continuous polyethylene plexifilamentary fiber strands, collecting said plexifilamentary fiber strands to form a sheet and bonding said sheet to form said nonwoven sheet comprised of substantially continuous polyethylene plexifilamentary fiber strands and having a hydrostatic head of at least 110 cm and a Gurley Hill Porosity of less than 6 seconds.

REMARKS

Claims 1-18 and 20-27 remain pending in the present application. The amendment to the units of "Surface Area" in Table 3 is made to correct a clear error in typing. Support for the amendment can be found at page 6, lines 23-26. The amendment to claims 5 and 6 finds support in original claim 19, hereby cancelled, and at page 16, lines 20-21 of the specification.

Applicants would like to thank the Examiner for extending them the courtesy of a telephone interview on 12 December 2002, in which primarily the formal rejection was discussed. During the interview, the Examiner indicated that said rejection might be overcome by reciting the claims in a product-by-process format. Applicants have added such product-by-process claims 28-30, corresponding to independent claims 1, 5 and 6 respectively. Support for new claims 28-30 is found at page 12, lines 11-28. No new matter is added.

Rejection under 35 U.S.C. § 112, second paragraph

Claims 1-19 and 21-27 stand rejected under 35 U.S.C. § 112, second paragraph as being indefinite in view of *Ex parte Slob* (citation omitted). Applicants traverse this basis for rejection and respectfully request reconsideration and withdrawal thereof.

In the present application, the Examiner has rejected the independent claims 1, 5 and 6 as being indefinite *per se*, in view of *Ex parte Slob*, rather than analyzing the limitations that are actually in the claims. The Examiner's analysis of the claims is entirely analogous to the practice of deriving an obviousness rejection directly from case law, rather than from the inquiry mandated by the statute, which practice was admonished in *In re Ochiai*, 71 F.3d 1565, 37 USPQ2d 1127, 1132 (Fed. Cir. 1995):

> the examiner incorrectly drew from *Durden*, a case turning on specific facts, a general obviousness rule...Mere citation of [case law] as a basis for rejecting process claims that differ from the prior art by their use of different starting materials is improper, as it sidesteps the fact-intensive inquiry mandated by section 103....This method of analysis is founded on legal error because it substitutes supposed *per se* rules for the particularized inquiry required by section 103.

Accordingly, Applicants respectfully request withdrawal of the formal rejection and reconsideration of the definiteness of each of the claim limitations, as required in *In re Wakefield*:

> Section 112 does not require that the claims define "the invention"...[but] that the claims define "the subject matter which the applicant regards as his invention." The meaning of this provision is simply that an applicant is required to set definite boundaries on the patent protection sought...*The scope of the claim is definite...[if] each recited limitation is definite. In re Wakefield and Foster*, 422 F.2d 897, 164 U.S.P.Q. 636, 641 (CCPA 1970), emphasis added.

Rejection under 35 U.S.C. § 102(b) over Lim et al.

Claims 5, 26 and 27 stand rejected under 35 U.S.C. § 102(b) as anticipated by Lim et al. (U.S. Patent no. 5,290,628; hereinafter Lim '628). Applicants traverse this basis for rejection and respectfully request reconsideration and withdrawal thereof.

Lim et al. disclose a process for hydraulically needling a web of staple fibers into an unbonded flash spun web made of continuous plexifilaments, in which a web of staple fibers is positioned against an unbonded flash spun web (Abstract). Accordingly, the Lim '628 process would result in a composite fabric having a layer of staple fibers and a layer of flash spun plexifilamentary fibers.

In contrast, claim 5 is directed to a nonwoven *unitary* fibrous sheet comprised of substantially continuous polyethylene plexifilamentary fiber strands which is a substantially homogeneous layer that is free of distinguishable laminations or other support structures (specification, page 6, lines 4-7). A composite sheet according to

Lim '628 cannot anticipate the unitary sheet of claim 5. Withdrawal of the rejection is requested.

Rejection under 35 U.S.C. § 102(e) over Lim et al.

Claim 6 stands rejected under 35 U.S.C. § 102(e) as anticipated by Lim et al. (U.S. Patent no. 6,034,008; hereinafter Lim '008). Applicants traverse this basis for rejection and respectfully request reconsideration and withdrawal thereof.

Lim '008 discloses improved sheets of flash-spun plexifilamentary film-fibrils useful in microfiltration of fluids and sterile packaging (Abstract). The Examiner directs attention to Example 27, which discloses such a flash-spun sheet having a hydrostatic head of 117 cm, and to Example 30, which discloses a different flash-spun sheet having a Gurley Hill porosity of 5 seconds.

In contrast, claim 6 is directed to a flash-spun nonwoven sheet comprised of substantially continuous polyethylene plexifilamentary fiber strands and having a combination of a hydrostatic head of at least 110 cm and a Gurley Hill Porosity of less than 6 seconds. Neither of the sheets described in Lim '008, relied upon by the Examiner, demonstrates this combination of properties. Example 27 of Lim '008 (col. 14, Table 5) has a hydrohead of 117 cm, but a Gurley Hill Porosity of 11 seconds, well above the claimed range. Likewise, Example 30 of Lim '008 (cols. 14-5, Table 5 continued) demonstrates a Gurley Hill porosity of 5 seconds, but a hydrostatic head of only 76.5 cm.

Accordingly, the disclosure of Lim '008 cannot be said to anticipate claim 6. Withdrawal of the rejection is requested.

Rejection under 35 U.S.C. § 102(b) over Steuber

Claims 20, 25 and 26 stand rejected under 35 U.S.C. § 102(b) as anticipated by Steuber (U.S. Patent no. 3,169,899). Applicants traverse this basis for rejection and respectfully request reconsideration and withdrawal thereof.

Steuber discloses nonwoven fibrous sheets of continuous strand materials and methods of making the same (Title, col. 1), including a number of different flash-spun sheets, spun from various polymer and spin agent combinations. Steuber suggests a variety of bonding techniques for his flash-spun sheets, including compressing the sheet between coacting compressive plates or rollers, with or without application of heat, and air-fusing in an oven circulating hot air of a temperature between about 126-135°C (col. 7-8, generally; specifically col. 7, lines 21-29).

In contrast, claim 20 of the present application is directed to a through-air bonded polyethylene plexifilamentary nonwoven sheet. Through-air bonding is described at page 13, lines 3-16 of the present specification, wherein Applicants indicate that such process includes drawing hot air through the web to effect bonding of the individual fibers at their crossover points. Applicants disclose that through-air bonding requires that the plexifilamentary web have a Frazier permeability of at least 2 $ft^3/min/ft^2$ (page 13, lines 10-16).

The Examiner suggests that the hot air bonding disclosed by Steuber is through-air bonding, which would form a sheet anticipating claim 20. Applicants traverse and suggest that the hot air bonding process disclosed by Steuber fails to indicate that the hot air is actually drawn through the web; accordingly, Steuber only requires placement of the flash-spun web into the hot air oven, such that the heat of the oven acts to bond the fibers, without drawing the hot air through the web. Steuber never discloses or suggests that the flash-spun webs must have at least a lower limit of air permeability (Frazier) to effect such bonding. As such, Steuber cannot be said to anticipate claim 20, and therefore not claims 25 and 26. Withdrawal of the rejection is requested.

Rejection under 35 U.S.C. § 102(b)/103(a) over Steuber

Claims 1-19 stand rejected under 35 U.S.C. § 102(b) as anticipated by, or in the alternative under 35 U.S.C. § 103(a) as obvious in view of Steuber. Applicants traverse this basis for rejection and respectfully request reconsideration and withdrawal thereof.

The Examiner directs attention to the description of Steuber set forth in the previous rejection (Office Action, page 4, section 5) as setting forth the basis for the present rejection of the claims.

Steuber discloses formation of plexifilamentary film-fibrils having a surface area of greater than 2 m^2/g (col. 3, lines 70-75; col. 4, lines 6-11; and col. 7, lines 15-16), which the Examiner apparently believes to anticipate claim 1 of the present application. However, while claim 1 requires the plexifilamentary strands to have a surface area of less than 10 m^2/g, it also requires a crush value of at least 1 mm/g, a quality neither disclosed nor suggested by Steuber. Clearly, Steuber cannot be said to anticipate claim 1.

Notably, Steuber discloses that his webs have low resiliency (col. 6, lines 44-68), quite the opposite of the strands of claim 1 of the present application. Measurement of crush values is described at page 6, bridging to page 7 of the present specification, wherein Applicants indicate that

> crush value is a measure of how much the sample recovers its original size after being crushed... (page 7, lines 29-31).

Accordingly, Applicants respectfully submit that Steuber cannot be said to make obvious the limitations of claim 1, as it essentially teaches away from resilient webs/fibers.

As to the limitations of claims 5 and 6, respectively directed to Frazier permeability (claim 5) and the combination of hydrostatic head and Gurley Hill porosity (claim 6), the Examiner fails to address these limitations in this section of the Office Action, but in section 8 (Office Action, page 5), the Examiner recognizes that such limitations are absent from Steuber and indicates that the rejection is based upon an inherency argument. For the purpose of addressing the present rejection, Applicants will presume that the Examiner intended to make such an inherency argument in section 7 of the Office Action.

The Examiner argues that

> a nonwoven having the desired combination of Frazier permeability, hydrostatic head and Gurley Hill porosity values as recited in claims 5-19...[would be] inherent to the inventions of...Steuber. Support for said presumption is found in the use of like materials (i.e. polyhydrocarbons) and the use of like processes (i.e. spinning synthetic polymers for the production of plexifilaments), which would result in the claimed property. (Office Action, page 5, section 8, bridging to page 6).

Applicants traverse the Examiner's argument as to the inherency of the claimed limitations of Frazier, hydrostatic head and Gurley Hill porosity in the Steuber plexifilamentary webs. In support, the Examiner's attention is redirected to Lim '628, wherein it is disclosed

> [a]lthough unconsolidated flash spun sheets have fairly high permeability in the unfused state, it is lost when the sheet is thermally bonded since fusing reduces permeability to a level that is unsuitable for sensitive filtration applications (e.g. vacuum cleaner bags)... . Because of the limited ability of the flash spinning and thermal bonding process to increase permeability beyond a Gurley-Hill porosity of about 8 second/100

> cc, there is a significant need for a method to be developed which will increase or even maintain the permeability to a Frazier porosity of at least 4 ft^3/ft^2/min following thermal bonding. (Col. 1, lines 38-52; emphasis added).

Lim '628 accomplishes this task by needling staple fibers from a staple fiber web into a flash spun web (which would clearly result in reduction of hydrostatic head values). Therefore, it is clear from Lim '628 that a web having a Gurley Hill porosity value of less than 6 seconds (claim 6), or a Frazier permeability of greater than 2 cfm/ft^2, normalized to a basis weight of 1 $ounce/yd^2$ (claim 5), could not be achieved by prior art methods (notably, Steuber is indicated as having been considered during prosecution of Lim '628).

Further, the Examiner's attention is directed to the exemplary data of the present application, wherein Applicants demonstrate that flash-spun webs which are produced under conditions even closer to those of the present invention (as compared to Steuber), and which are made of the same polymer, i.e. polyethylene, can have quite different permeability (Frazier and Gurley Hill) and barrier (hydrohead) properties. For instance, Example A, which is made from the same polymer as those of the inventive examples but by a process in which the polymer concentration and spinning temperature are varied, is disclosed to have a Gurley Hill porosity of 131 seconds, and an unmeasurable Frazier permeability. In contrast, Examples 1-5 of the present invention are disclosed to have essentially unmeasurable Gurley Hill porosities (i.e. their permeability is too great), and Frazier permeabilities of greater than 13.2 cfm/ft^2 (Table 1, page 22). It is also interesting to note that the Examples of the present invention maintain greater hydrostatic head values than the Comparative Example A.

Therefore it is clear that one skilled in the art would not be able to predict permeability and barrier properties based merely upon the polymer composition of the flash-spun web, as suggested by the Examiner.

Further, in traverse of the Examiner's suggestion that the process of Steuber and that of the present invention are "like processes", Applicants direct attention to the differences. Steuber discloses a spinning apparatus which incorporates a 50 gallon autoclave 15 and an oscillating deflector 22 (Fig. 1; col. 4, lines 48-75), a decidedly laboratory-scale apparatus. Steuber further discloses a formulation of about 11 wt% polyethylene in methylene chloride as the spinning solution (col. 10,

lines 1-5), a completely different spinning solvent as compared to that disclosed in the present application, which is a mixture of pentane and cyclopentane. Additionally, the present application discloses a flash spinning apparatus designed (and incidentally in use) for commercial production (Fig. 1 and page 10, lines 21-24). Accordingly, the spinning parameters are quite different between the presently disclosed process and that of Steuber, as are the film-fibril laydown and collection processes which form the web. It can hardly be said that the processes of Steuber and that of the present application are "like processes", as is proposed by the Examiner.

Therefore, it is clear that the presently claimed properties are almost certainly not "inherently" contained in the flash-spun webs of Steuber; nor is there any suggestion in Steuber as to how to modify his methods to obtain such properties. Withdrawal of the rejections under 35 U.S.C. 102 and/or 103 is requested.

Rejection under 35 U.S.C. § 102(b)/103(a) over Blades

Claims 1-19 stand rejected under 35 U.S.C. § 102(b) as anticipated by, or in the alternative under 35 U.S.C. § 103(a) as obvious in view of Blades (U.S. Patent no. 3,081,519). Applicants traverse this basis for rejection and respectfully request reconsideration and withdrawal thereof.

The Examiner relies on a finding of inherency in support of the rejection over Blades.

Applicants reiterate their comments made above in traverse of Steuber with respect to Blades. In regard to its effect as prior art, Blades suffers from the same deficiencies as Steuber. As has been discussed above, it is not certain that the fibers prepared by Blades could be collected into and form a sheet having permeability and/or barrier limitations within the present claims. Nor does Blades provide any suggestion as to how to modify his invention to obtain nonwoven sheets having such permeability and/or barrier limitations.

Withdrawal of the rejections under 35 U.S.C. 102 and/or 103 is requested.

Rejection under 35 U.S.C. § 102( )/103(a) ov r Bisbis

Claims 5-19 and 21-23 stand rejected under 35 U.S.C. § 102(e) as anticipated by, or in the alternative under 35 U.S.C. § 103(a) as obvious in view of Bisbis (U.S.

Patent no. 5,919,539). Applicants traverse this basis for rejection and respectfully request reconsideration and withdrawal thereof.

Bisbis discloses a method for ultrasonically joining flashspun bonded polyolefin sheets and a seam generated by such method. The process itself is irrelevant to the rejection set forth by the Examiner. The Examiner cites Bisbis for the disclosure therein of Tyvek® Style 1422A, which is also disclosed to have a hydrohead of 130 cm, and for its disclosure of the bonding patterns set forth in claims 21-23 of the present application.

Recognizing that Bisbis fails to disclose any level of air permeability, the Examiner once again relies upon a finding of inherency to support the rejection, arguing that since the Bisbis fabrics are made of flash spun polyethylene, as are the sheets of the present claims, the Bisbis fabrics must therefore have the same physical characteristics as claimed herein.

Applicants have addressed this logic above, with respect to the rejections over Blades and Steuber, and once again respectfully suggest that it is without merit. In further evidence of Applicants' position, the Examiner's attention is directed to WO 98/07908, of record in the present application, wherein it is disclosed that Tyvek® Style 1422A has a Gurley Hill porosity of 18.7 sec. (page 33, lines 20-21; Table 7, Example 39), well above the limit of the present claims.

Clearly, Bisbis fails to anticipate the present claims. Withdrawal of the rejection under 35 U.S.C. § 102(e) is requested on this basis.

As to the Examiner's alternative rejection under 35 U.S.C. § 103(a), Applicants respectfully point out that Bisbis is unavailable as a reference pursuant to 35 U.S.C. § 103(c), because both Bisbis and the presently claimed invention were commonly owned by E.I. du Pont de Nemours and Company at the time of development of the present invention. Withdrawal of the rejection is requested on this basis.

Rejection under 35 U.S.C. § 102(b)/103(a) over Lim '628

Claims 6-19 and 24-27 stand rejected under 35 U.S.C. § 102(b) as anticipated by, or in the alternative under 35 U.S.C. § 103(a) as obvious in view of Lim '628. Applicants traverse this basis for rejection and respectfully request reconsideration and withdrawal thereof.

Applicants reiterate their comments in traverse of the rejection over Lim '628 as set forth above. That is, Lim '628 discloses a composite sheet, on one side of

which is a flash spun layer and on the other side of which is a staple fiber web. In contrast, claim 6 has been amended to clarify that it is directed to a nonwoven unitary fibrous sheet which is composed of substantially continuous polyethylene plexifilamentary fiber strands. Lim '628 cannot anticipate claim 6 of the present application.

Claims 7-19 and 24-27 are ultimately dependent upon claim 5 (or 20) and not claim 6, and as such are not properly rejected. However, since claim 5 has been demonstrated to be patentable over Lim '628 for the same reason as set forth herein, Applicants submit that rejection of claims 7-19 and 24-27, even in view of claim 5, is improper.

Further, Applicants traverse the Examiner's suggestion of the inherency of the limitations of claim 6 being in the Lim '628 spun laced sheets. As has been demonstrated above, the mere fact that Lim '628 contains a flash spun polyethylene sheet layer would not necessitate that it have the combination of hydrohead and Gurley Hill porosity of claim 6. In fact, and further in support of their position, Applicants submit that the hydraulic needling process conducted according to Lim '628, while acting to enhance air permeability (Frazier), will actually reduce or eliminate the hydrohead that would normally have been present in the flash spun layer, due to the proliferation of holes formed by the needling process in the flash spun sheet. Accordingly, the fabrics of Lim '628 almost certainly do not have hydrohead values anywhere close to those of the present claims.

Withdrawal of the rejections is requested.

Respectfully submitted,

Thomas W. Steinberg

THOMAS W. STEINBERG
ATTORNEY FOR APPLICANTS
REGISTRATION NO. 37,013
TELEPHONE: (302) 892-0887
FACSIMILE: (302) 892-7343

Dated: 2/12/03

TWS:fgl
Enclosure

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In showing the changes, deleted material is shown in brackets, and inserted material is shown underlined, with the exception of the underlined titles within Table 3, which are present in the original disclosure.

IN THE SPECIFICATION:

At Table 3, page 27, please amend as follows.

Table 3 – Crush Testing

Example	C	B	D	E	9	10
Spinning Conditions						
Polymer Concentration (wt%)	18	17	17.5	15.8	20	16
Spinning Temperature (°C)	185	190	198	200	211	207
Letdown Pressure (psi)	700	960	1100	-	1310	-
Screens	7x50	none	none	none	7x50	None
Spin Orifice L/D	4/1	Std	Std	Std	4/1	Std
Entrance Angle (degrees)	23.6	60	60	60	23.6	60
Tunnel	Rad	No rad	No rad	No rad	Rad	No rad
Crush Properties						
Actual Crush Height	13.7	11.3	20.7	9.0	15.0	9.3
Normalized Crush Height (mm) (Normalized to 1 g)	7.3	6.3	7.8	5.9	5.8	5.8
Restored Height (mm)	14.9	12.4	22.4	10.3	23.6	11.4
Crush value (mm/g)	0.66	0.61	0.64	0.86	3.35	1.32
Surface Area ([g/m^2] m^2/g)	19.73	14.78	17.12	11.16	2.89	6.36

At Table 3 (continued), page 28, please amend as follows.

Table 3 (Cont.)

Example	11	12	1	13	14	15
Spinning Conditions						
Polymer Concentration (wt%)	18	14	18	16	16	20
Spinning Temperature (°C)	208	209	209	210	210	218
Letdown Pressure	-	1520	1390	1370	1350	1415
Screens	None	7x50	7x50	None	7x50	7x50
Spin Orifice L/D	Std	4/1	4/1	std	Std	4/1
Entrance Angle (degrees)	60	23.6	23.6	15 °	23.6	23.6
Tunnel	No rad	No rad	Rad	No rad	Rad	Rad

Crush Properti s						
Actual Crush Height(mm)	16.7	12.0	13.3	13.3	15.3	13.7
Normalized Crush Height (mm) (Normalized to 1 g)	6.9	5.5	5.8	6.3	7.1	5.3
Restored Height (mm)	19.4	15.9	20.5	19.1	17.5	28.3
Crush value (mm/g)	1.13	1.78	3.13	2.75	1.02	5.71
Surface Area ([g/m^2] m^2/g)	8.07	3.57	3.30	4.6	7.5	1.7

IN THE CLAIMS:

5. (Amended) A nonwoven unitary fibrous sheet comprised of substantially continuous polyethylene plexifilamentary fiber strands and having a Frazier Permeability, normalized to 1.0 oz/yd^2 basis weight, of at least 2 cfm/ft^2.

6. (Amended) A nonwoven unitary fibrous sheet comprised of substantially continuous polyethylene plexifilamentary fiber strands and having a hydrostatic head of at least 110 cm and a Gurley Hill Porosity of less than 6 seconds.

Claim 19, delete in its entirety.

Please add the following new claims:

28. A polyethylene plexifilamentary fiber strand produced by a process comprising flash spinning a solution of 12% to 24% by weight polyethylene in spin agent comprising pentane and cyclopentane at a spinning temperature from about 205°C to 220°C to form said plexifilamentary fiber strand having a surface area of less than 10 m^2/g and a crush value of at least 1 mm/g.

29. A nonwoven unitary fibrous sheet produced by a process comprising flash spinning a solution of 12% to 24% by weight polyethylene in spin agent comprising pentane and cyclopentane at a spinning temperature from about 205°C to 220°C to form substantially continuous polyethylene plexifilamentary fiber strands, collecting said plexifilamentary fiber strands to form a sheet and bonding said sheet to form said nonwoven unitary fibrous sheet comprised of substantially continuous polyethylene plexifilamentary fiber strands and having a Frazier Permeability, normalized to 1.0 oz/yd^2 basis weight, of at least 2 cfm/ft^2.

30. A nonwoven sheet produced by a process comprising flash spinning a solution of 12% to 24% by weight polyethylene in spin agent comprising pentane and

cyclopentane at a spinning temperature from about 205°C to 220°C to form substantially continuous polyethylene plexifilamentary fiber strands, collecting said plexifilamentary fiber strands to form a sheet and bonding said sheet to form said nonwoven sheet comprised of substantially continuous polyethylene plexifilamentary fiber strands and having a hydrostatic head of at least 110 cm and a Gurley Hill Porosity of less than 6 seconds.